



ESA21

Environmental Science Activities for the 21st Century

Ground-level Ozone: Your Vehicle

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Ground-level Ozone: Vehicles

In this week's exercise, you will be quantifying and analyzing your personal contributions of smog-forming compounds due to driving. You are likely already aware that vehicles can be a significant contributor of the compounds that cause ground-level ozone. In this exercise you will examine your personal contributions of smog-forming compounds from driving. To begin your analysis, let's review information on vehicles and ozone with an online brochure from the Federal Highway Administration of the U.S. Department of Transportation on Transportation Air Quality.



[Vehicle Emissions](#) (PDF) (448 KB)

United States Federal Highway Administration (Department of Transportation)

<http://www.fhwa.dot.gov/environment/>

In this exercise you will be examining your individual emissions of ozone-forming compounds from driving. To do this, we will use the "Gas Mileage Impact Calculator" from the Hybridcars.com. This calculator provides you with an estimate of your outputs of smog-forming nitrogen oxides and hydrocarbons (VOC's) for your vehicle and driving habits. As you learned in the Transportation Air Quality brochure, a number of factors influence NO_x and VOC emissions from vehicles. While this calculator does not take all of these factors into account, it does provide a good estimation of your emissions.

[Gas Mileage Impact Calculator](#)

Hybridcars.com

<http://www.hybridcars.com/calculator/index.php/>

Tailpipe Tally:	
1.	Select your vehicle's make, model, engine, and emissions level with the pull-down menus.
2.	Choose a hybrid vehicle that is similar to yours in size and select its model, engine, and emissions level from the pull-down menus on the right side. Hit the <i>Next</i> button to proceed.
3.	Enter your average annual mileage for your vehicle using the slider or by entering the number in the text box. Enter the current price of a gallon of gasoline and hit <i>Next</i> to proceed.
4.	Click the words "Evaluate Driving Habits" to reveal a series of assumptions about your driving habits. Keep those that apply to your driving style checked, uncheck those that do not apply. Close the Driving Habits box by clicking on the "X" in the boxes' upper right corner.
5.	View your results and answer the related questions on the Activity sheet.
6.	Use the <i>Previous</i> button to return to Step 1. Keep your vehicle the same and repeat steps 2-5 for a second hybrid vehicle.

Air Pollution and Asthma

DO NOT COMPLETE THIS SECTION UNTIL YOU'VE COMPLETED THE ACTIVITY ABOVE. You are undoubtedly aware that many parts of the U.S. have annually reoccurring smog problems. Metropolitan areas like Los Angeles, Houston, Atlanta, and others have often exceed federal air quality standards, posing a health risk to individuals living in the area. While everyone can experience health problems from smog, it is particularly severe for individuals with respiratory ailments such as asthma, as air pollution can act as a "trigger" for respiratory attacks. The American Lung Association states that 24.7 million individuals have been diagnosed with asthma, and about one-third of them are children. Asthma is particularly troubling in children, as it is the number one cause of hospitalization and school absenteeism.

Asthma and Children Fact Sheet

American Lung Association

<http://www.lungusa.org/lung-disease/asthma/resources/facts-and-figures/asthma-children-fact-sheet.html>

ESA 21: Environmental Science Activities

Activity Sheet
Ground-level Ozone:
Your Vehicle

Name:

Instructor:

Gas Mileage Impact Calculator:

Enter your vehicle's year, make, model, emissions certification, and annual mileage below.

Make	Model	Engine	Emissions Level	Annual Mileage

Enter your annual outputs of nitrogen oxides and hydrocarbons for your vehicle in the space below. Enter the information for the first hybrid comparison in "Hybrid 1" and the second hybrid vehicle comparison in "Hybrid 2", being sure each time to list the make and model of the hybrid vehicle. Circle whether each vehicle's emissions are **higher** or **lower** than your vehicle, and enter the difference in emissions next to **Amount**.

Vehicle	NO _x (lbs.)	Hydrocarbons (lbs.)	Difference: NO _x	Difference: Hydrocarbons
Your Vehicle			*****	*****
Hybrid 1:			Higher Lower Amount:	Higher Lower Amount:
Hybrid 2:			Higher Lower Amount:	Higher Lower Amount:

Analysis:

Vehicle Emissions:

Compare your vehicle to the selected hybrid vehicles. How did your vehicle compare? Did this surprise you?

Asthma and Air Pollution:

You've seen that asthma affects large numbers of individuals, attacks can be induced by air pollutants, pollution may act to cause individuals to develop the disease, and asthma attacks are an extremely unpleasant event to endure. You've also likely seen that your current vehicle emits more ozone-forming compounds than a gasoline-electric hybrid vehicle (Toyota Prius) and/or a typical compact car (Ford Focus). So here's the problem - you are, by choice, releasing more harmful pollutants into the atmosphere than if you were to drive these other vehicles for exactly the same distance. These pollutants induce attacks in asthmatics, and may cause children and adults to develop asthma as a result of exposure to your pollution.

Is it morally problematic for you to drive a vehicle that gets lower mileage (and hence releases more pollutants) than another vehicle when you are aware of the adverse impacts of your choice on others?

You should address the question from a variety of viewpoints (ethical, scientific, philosophical, economic, etc). Think about the question carefully before answering, and be sure to explain yourself fully.

Vehicle Emissions Testing:

In many areas, vehicles must have annual emissions testing for ozone-forming compounds. Such programs are designed to improve air quality by identifying those vehicles emitting large amounts of ozone precursors. Do you support such testing programs? Has your view on the matter changed after completing this exercise? Explain your answer.